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**Center Office:** IRIS Center, 2105 Morrill Hall, College Park, MD 20742

Telephone (301) 405-3110 • Fax (301) 405-3020

## **A Simple test of the nutrition-based efficiency model**

**Anand V. Swamy**

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Author: Anand V. Swamy, Department of Economics, University of Maryland, College Park, IRIS Center.

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## A simple test of the nutrition-based efficiency wage model<sup>1</sup>

Anand V. Swamy

Department of Economics, University of Maryland, College Park, MD 20742, USA

**Abstract**

In the nutrition-based efficiency wage model wages in labor markets in developing countries are rigid because lowering them would reduce worker productivity and increase the cost per efficiency unit. I evaluate this claim, using data from rural India. I find that, contrary to what has been assumed in these models, a wage cut should lower the cost per efficiency unit of labor. © 1997 Elsevier Science B.V.

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### 1. Introduction

Among the several variants of efficiency wage models, one has been considered especially relevant for developing countries: the *nutrition-based* efficiency wage model. This model was first proposed by Liebenstein (1957) and Mazumdar

<sup>1</sup> This paper is a revised version of Chapter 4 of my dissertation. I am grateful to Joe Altonji, Joel Mokyr, Chris Udry, and Tara Vishwanath for valuable advice and encouragement. I also thank Katharine Abraham, Gaurav Datt, Brian Fikkert, Andrew Foster, Mark Rosenzweig, Bob Schwab, and seminar participants at the University of Maryland and the World Bank for helpful comments. This publication was made possible through support provided by the US Agency for International Development under Cooperative Agreement No. DHR-0015-A-00-0031-00 to the Center on Institutional Reform and the Informal Sector (IRIS) and administered by the Office of Economic and Institutional Reform, Center for Economic Growth, Bureau for Global Programs, Field Support and Research. I also thank the Alfred P. Sloan foundation for financial support.

(1959). Any model of equilibrium involuntary unemployment has to address the following question: What prevents unemployed workers from obtaining employment by bidding down the wage? According to the nutrition-based efficiency wage model (EWM), employers do not lower the wage because the worker would then consume less, thereby lowering his productivity; paying a lower wage may raise the cost per efficiency unit of labor. Thus, the wage will not be lowered because (Mokyr, 1991) “cheap labor is dear labor.”<sup>2</sup>

This explanation for wage rigidity has been very difficult to test. It has been widely discussed,<sup>3</sup> but the approaches taken thus far have been indirect and do not evaluate the fundamental premise of the model: Is cheap labor really dear labor? Is it true that cutting the wage will raise the cost per efficiency unit of labor? Until recently, the lack of good evidence regarding the strength of the relationship between productivity and nutrition prevented examination of this issue. Recent work by several different authors has provided good estimates of the impact of calorie consumption on worker productivity. In the present paper I examine the potential nutritional consequences of a cut in wages and assess the resulting impact on productivity. I then compare the cost per efficiency unit of labor at two different wages (the prevailing wage and a lower wage) and check whether cutting the wage will actually increase the cost per efficiency unit. The paper's central finding is that, contrary to what is assumed in the nutrition-based efficiency wage model, cutting wages should reduce the cost per efficiency unit of labor. If wages are rigid, it cannot be due to nutrition considerations alone.

The remainder of this paper is organized as follows. Section 2 outlines the nutrition-based efficiency wage model. Section 3 reviews the existing empirical evidence. Section 4 outlines a method for testing whether cutting wages will raise the cost per efficiency unit of labor. Section 5 provides some examples. Section 6 discusses our findings and some qualifications and

## 2. The model<sup>4</sup>

### 2.1. The efficiency wage model with homogenous workers

Suppose the relationship between the wage and productivity is as depicted in Fig. 1. The productivity of the worker is given by the function  $E(W)$ , where  $W$  is the wage. Let the employer's increasing, strictly concave production function be

<sup>2</sup> Other theoretical work in this framework includes Basu (1991), Bliss and Stern (1978), Dasgupta and Ray (1986, 1990), Dasgupta (1993), Gersovitz (1983), Guha (1989), Mirrlees (1975), and Ray and Streufert (1993).

<sup>3</sup> See, for example, Bardhan (1984), Drèze and Mukherjee (1989), Foster and Rosenzweig (1993), Rodgers (1975), and Rosenzweig (1988).

<sup>4</sup> The model described in the first part of this section is exactly that in Mirrlees (1975).

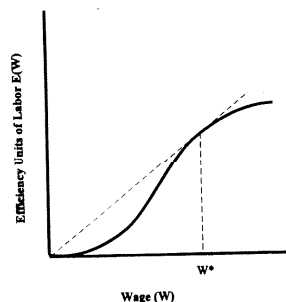


Fig. 1.

$F[nE(W)]$ , where ' $n$ ' is the number of workers. The employer's maximization problem (assuming the worker's reservation wage does not bind) is:

$$\max_{n, W} F[nE(W)] - nW$$

The optimal wage for the employer is  $W^*$ , at which  $E(W)/W = E'(W)$ . Suppose at this optimal wage  $n^*$  workers are hired. If the supply of workers exceeds  $n^*$ , some workers will be involuntarily unemployed. Unemployed workers will not be able to undercut employed workers because lowering wages will reduce the employer's profits. The assumption of increasing returns is crucial, since with diminishing or constant returns the cost per efficiency unit cannot rise when the wage is cut.

### 2.2. The efficiency wage model when workers have different amounts of wealth

The above model assumes that the worker's productivity depends only on the wage he/she receives. Of course, workers consume income obtained from sources other than labor. Also, they differ in the amount of non-labor income they receive. Thus, the productivity of the worker can be written as  $E[W + g(z)]$ , where  $z$  is the wealth of the worker and  $g$  is an increasing function. Dasgupta and Ray (1986) have examined the nutrition-based efficiency wage model in a general equilibrium setting when workers possess different amounts of wealth. In such a model wealthier workers have an advantage in the labor market. This is because for any given wage they consume more nutrients and are more productive. Therefore, in the D–R model wealthier workers will find work; the poorer workers may not.

Dasgupta and Ray analyze a competitive labor market. In equilibrium all employers pay the same cost (say,  $x^*$ ) per efficiency unit of labor. There is some threshold level of wealth below which the worker cannot find employment. This is because poor workers have limited sources of nutrition aside from the wage; at any wage their productivity is so low that it is not worth hiring them. This can be written as:

$$\min_w W/[E(W + g(z))] \geq x^* \quad (1)$$

For example, the minimum cost at which a worker whose only source of income is labor ('landless') can supply labor is  $W^*/E(W^*)$ . If this figure is greater than  $x^*$  no landless worker can find work. If it is exactly equal to  $x^*$  some landless workers may find work and others may not. The unemployed landless workers will not be able to undercut the employed landless workers. Our goal is to evaluate whether Eq. (1) will be satisfied for a landless worker.

### 3. Testing the model: literature review

There are two distinct issues when it comes to empirical testing. First, does better nutrition increase productivity? Second, if nutrition does affect productivity, does this lead to an equilibrium with unemployment? I discuss the literature concerning each of these issues, in turn, below. I concentrate on the evidence pertaining to India, since this is the focus of my paper.

The studies which provide estimates of the impact of nutrition on productivity rely on the widely used ICRISAT data, collected from three villages in South India. These are Deolalikar (1988) and Behrman and Deolalikar (1989). Deolalikar finds that medium-term nutritional status, as measured by weight-for-height, does impact wages and farm output. However, average daily caloric intake has no impact on either wages or farm output. Behrman and Deolalikar use the same data, but they disaggregate it by season and now find that caloric intake does impact peak season wages (but not slack season wages). They regress the log of the wage on calories, calories times peak season dummy, peak season dummy, weight-for-height, weight-for-height times peak season dummy, schooling, experience, and experience squared. The regressions are run separately for men, women, and are also pooled. The preferred estimates are obtained using the instrumental variable approach, in order to account for the potential endogeneity of caloric intake. In this paper we are arguing that nutrition considerations cannot explain wage rigidity. We will pick from the estimates in Deolalikar (1988) and Behrman and Deolalikar (1989) the one which is most favorable to the EWM, i.e. the estimate which indicates the strongest impact of caloric intake on productivity. We will then argue that even with this estimate nutrition-related wage-rigidity is not plausible. As it turns out the strongest impact of caloric intake is on peak season

wages (these are IV estimates for the pooled sample of men and women); a 1-calorie increase in daily intake increases the log wage in the peak season by 0.0001238. Using this estimate, increasing consumption from (say) 2500 calories to 5000 calories will increase the wage by 36.27%.<sup>5</sup> Similar analyses have been conducted in other contexts as well, such as the Philippines (Bouis and Haddad, 1991, Foster and Rosenzweig, 1993, 1994), Sierra Leone (Strauss, 1986), and Sri Lanka (Sahn and Alderman, 1988).

There is, however, little empirical testing of the efficiency wage model as a theory of unemployment. By and large work has focused on wage rigidity and wage-dispersion. Rodgers (1975) argues that since nutrition affects productivity with a lag, we should expect to see long-term contracts. We should also find that the (nutritionally determined) wage is insensitive to demand fluctuations. He finds support for these predictions in his study of the Kosi region of Bihar, India.

Contrary evidence which suggests that real wages vary in a manner which is not consistent with the efficiency wage model is discussed in Bardhan (1984, Rosenzweig (1988), and Drèze and Mukherjee (1989). None of these papers systematically addresses a key question: Is it true that reducing the wage will reduce the employer's profits? If the landless (unemployed) worker offers to work for a very low wage, how many calories will he consume? How productive will he be when consuming these calories? Will his productivity be so low that it will not be worth hiring him even for a very low wage? The next section outlines a method for addressing this question.

### 4. Is undercutting feasible?

It has been argued (Mokyr, 1985, Subramanian and Deaton, 1994) that, in the context of 19th century Irish agriculture and contemporary Maharashtra (India), the calorie equivalent of the wage is simply too high for it to be an efficiency wage. If the employer is setting the wage based on nutrition considerations, there is no reason for it to be able to buy more than (say) 5000 calories, since beyond that point nutrition does not affect productivity. In fact, in both these examples above the wage alone can buy much more than more than 5000 calories; hence Mokyr and Subramanian and Deaton argue that the EWM is not applicable in their contexts.

However, as Weiss (1992) points out, the worker's calorie intake cannot necessarily be controlled by the employer. The worker may share his wage with his family or spend it on other things. If the employer wants the worker to consume (say) 2500 calories, he may have to give him a wage that can buy (say) 8000 calories. Therefore, a wage that can buy him 8000 calories can be an efficiency wage. If a landless worker offered to work for 2500 calories he would

<sup>5</sup> Note that  $\exp(0.0001238 \times 2500) - 1 = 0.3627$ .

not be hired because the employer would be aware that he would consume only a fraction of this wage and would have very low productivity.

The above argument, however, overlooks the fact that the employer can set a floor to the worker's caloric intake, by paying in meals (provided just before work and during the work-day) thereby placing a ceiling on the cost per efficiency unit. Suppose that, in an effort to undercut, the landless worker offers to work for meals alone; the cost of these meals is  $M$  and they provide  $C$  calories. Assume that the relationship between calorie intake and worker productivity is captured by the function  $E(C)$ . The maximum possible cost per efficiency unit will be  $M/E(C)$ . Will the employer hire a landless worker who offers to work for meals alone? Suppose his currently employed worker receives wage  $W$  and consumes  $C^*$  calories, thus providing efficiency units of labor at cost  $W/E(C^*)$ . The landless worker will be able to undercut unless

$$M/E(C) \geq W/E(C^*) \quad (2)$$

I show in this paper that given prevailing wage rates in Indian agriculture and the magnitude of the impact of calorie intake on productivity, condition Eq. (2) cannot hold. The typical worker in Indian agriculture earns a wage which, given prevailing dietary habits, is worth more than 5000 calories. It is also clear that workers are often paid in meals; mid-day meals are extremely common and on occasion workers are also given additional meals or snacks, including breakfast. It is easy to provide the worker (say) 2500 calories in the form of meals, ensuring that he is consuming at least 2500 calories. Currently, the employed worker is typically receiving at least twice the wage that a worker who received only meals worth 2500 calories would get. But even if currently the employed worker is consuming as much as 5000 calories (which is an unreasonably high number), he is, going by Behrman and Deolalikar's estimates, only 36.27% more productive than one who consumes 2500 calories. The cost per efficiency unit of labor would fall if wages were cut, and workers were given only meals worth 2500 calories. It is of course necessary that the meals be provided just before or during the worker's period of employment.

It should be noted that payment in meals is very common in Indian agriculture. In Bardhan and Rudra's survey of 110 villages in West Bengal in 1979 (Bardhan and Rudra, 1983), in 74% of villages at least one of the modes of paying casual labor involved paying in meals. Long-term labor contracts were observed in 81 of the 110 villages. In 87% of these villages, meals were part of the long-term worker's wage. Payment of mid-day meal is also reported by numerous other studies like Bliss and Stern (1982, Mencher (1978), Rudra (1992).

## 5. Examples

To what kind of labor contracts does the EWM apply? On the one hand it has been argued (Bliss and Stern, 1978) that, since the returns to better nutrition are

Table 1  
Daily wage rates of adult male casual labor in Randam Village, Tamil Nadu, 1974

Operation	Wage rate	Calorie equivalent
Plucking seedlings	2 rupees + meal + porridge made of rice and ragi	5202 + meal + porridge
Coolie (well-digging, manuring, etc.)	2 rupees + meal + porridge made of rice and ragi	5202 + meal + porridge
First threshing	2.725–4.09 rupees	7088–10638
Second threshing	8.18 rupees	21276

Source: Harris (1982). Conversion of rupees into calories is at the rate of 2601 calories rupee<sup>-1</sup>. Harris provides data on the average monthly budget of landless laborer and marginal cultivator households, giving the amounts spent and the quantities purchased of rice, ragi, pulses, vegetables, milk, vegetable oil, and few other items. I have converted the physical quantities of these items into calories using the tables in Gopalan et al. (1989) and then computed the calories obtained per rupee.

only realized over time, the model is especially relevant to long-term contracts. On the other hand, it has also been argued (Eswaran and Kotwal, 1985) that long-term workers receive relatively high wages because they are more skilled and are assigned more important tasks. Such workers are likely to have wages which are higher than any nutrition-based floor. From this perspective the model is more applicable to unskilled casual laborers. We consider examples of both types of contracts.

Table 1 is drawn from the Harris (1982) study of a village in Tamil Nadu. These are daily wage rates of male casual laborers. As can be seen, the wage often includes a meal and a porridge made of rice and ragi.<sup>6</sup> Harris provides data on the average monthly budget of landless laborer and marginal cultivator households, giving the amounts spent and the quantities purchased of rice, ragi, pulses, vegetables, milk, vegetable oil, and few other items. I have converted the physical quantities of these items into calories using the tables in Gopalan et al. (1989) and then computed the calories obtained per rupee (2601). Using this estimate, we can see that the calorie equivalent of the daily wage rate for casual male agricultural laborers is, for all operations, in excess of 5200 calories. An employer can provide meals worth 1 rupee and ensure that the worker is consuming at least 2601 calories. At the prevailing wage the employed worker is getting a wage which is more than twice as high. However, even if the employed worker is consuming as much as 5000 calories he is, going by Behrman and Deolalikar's estimates, only 34.58% more productive than one who is consuming 2601 calories. Thus, an employer would receive efficiency units of labor cheaper if he cut the wage and paid only meals worth 1 rupee.

<sup>6</sup> A cereal, *Eleusine Coracana*.

Table 2  
Daily wage rates of adult male casual labor and permanent labor in Ferozepur, 1967–70

	Rupees	Calories obtained from spending 35% of daily wage on wheat
Lowest daily wage rate for male casual laborers (August)	5.08	7246
Daily wage rate of permanent laborers	4.56	6170

Source: Ministry of Agriculture, Government of India (1974a) and Rudra (1992). The survey provides daily male casual labor wages by month (average for 1967–68, 1968–69, 1969–70). I report the lowest figure, for the month of August. The permanent labor wage is also the average for the 3 years. The survey also reports that farm households on average spend 35% of the wage on cereal. The average price of wheat in August was 0.8367 rupees  $\text{kg}^{-1}$ . One kg of wheat contains 3410 calories (Gopalan et al., 1989). Thus, the first figure in Column 3 is computed as  $(5.08 \times 0.35 \times 3410) / 0.8367 = 7246$ . The second figure in Row 3 was computed similarly, except that I used the annual average price of wheat.

The widely used *Studies in the Economics of Farm Management* provide useful information on wage rates and prices of basic foodgrains in different districts of India. Only a few of them provide information on the family budget, which allows us to evaluate the caloric value of the wage in accordance with local dietary patterns. I have located two surveys which provide (a) wages of casual and permanent labor, (b) the fraction of food expenditure spent on cereals by cultivating households, and (c) the prices of cereals. Using these figures I compute the number of calories that would be obtained from cereal if a worker spent his wage on food, spending the same proportion on cereal as the typical cultivating household. This will give us an underestimate of the caloric equivalent of the wage for two reasons. First, we are not counting the calories obtained from expenditure on items other than cereal. Second, agricultural laborers, who are typically poorer than cultivating households, will likely spend a larger fraction of their food expenditure on cereal which, in the Indian context, is the cheapest source of calories (Behrman and Deolalikar, 1987, Subramanian and Deaton, 1994). However, as Tables 2 and 3 show even this underestimate of the caloric equivalent of the wage is typically more than 5000 calories.

Table 2 provides evidence taken from a Farm Management Survey of Ferozepur district, Punjab, over the period 1967–70, covering ten cultivating households each in 15 villages. For each month of each year the survey provides the average daily wage of male casual laborers. I have averaged these figures across the 3 years and picked the month for which we obtained the lowest figure (August), which is 5.08 rupees. The survey also reports the average daily wage of permanent laborers over the 3 years, which is 4.56 rupees (the annual wage divided by 365).

The family budget survey which was conducted alongside showed that the sampled households spent on average 35.01% of their food expenditure on cereal,

Table 3  
Daily wage rates of adult male casual labor and permanent labor in Muzaffarnagar, 1966–69

	Rupees	Calories obtained from spending 51% of wage on wheat
Daily wage rate of adult male casual labor for the lowest-paid operation (stripping of cane)	2.34	5217.3
Daily wage rate of permanent labor	2.71	6042

Source: Ministry of Agriculture, Government of India (1974b). The survey provides the daily casual male wage rate for each operation for each year. I computed the average wage (for 3 years) of each operation. The lowest figure was for stripping of cane (2.34 rupees). Sample farm households spend 51% of their food expenditure on cereal. The average price of wheat over the 3 years was 0.78 rupees  $\text{kg}^{-1}$ . Each kilogram of wheat contains 3410 calories (Gopalan et al., 1989). The top figure in the third column is computed as  $(2.34 \times 0.51 \times 3410) / 0.78 = 5217.3$ , and similarly for the second figure in column 3.

the remainder going to other food items. The average village price of wheat over the survey period was 0.882 rupees  $\text{kg}^{-1}$ . At this price if 35% of the permanent laborer's daily wage was spent on wheat, it would purchase 6170 calories. Similarly, if 35% of the lowest daily wage of the male casual laborer (which prevailed in the month of August) was spent on wheat, it would purchase 7246 calories. Thus if the wage consisted only of meals worth 2500 calories, it would be less than half the prevailing wage; however, even if the currently employed worker is consuming as much as 5000 calories, he is (using Behrman and Deolalikar's estimates) only 36.37% more productive than one who consumes 2500. Thus there is ample room for the wages of both casual and permanent laborers to be cut, reducing the cost per efficiency unit of labor.

The Farm Management Survey in Muzaffarnagar also covered ten households each in 15 villages. Daily wage rates for male casual labor are provided separately for each year for each operation. Again, I computed the average across the 3 years for each operation. The lowest of these figures is the daily wage for casual labor for stripping of cane, at 2.34 rupees (Table 3). Permanent laborers are paid on average the equivalent of 2.71 rupees  $\text{day}^{-1}$  (Rudra, 1992, p. 252). In this survey average cultivating families spend on average 51% of their food expenditures on cereal. At the average price of wheat (0.78 rupees  $\text{kg}^{-1}$ ), if 51% of the lowest daily wage of male casual laborers was spent on wheat this would yield 5217 calories. If 51% of the daily wage of permanent laborers was spent on wheat this would yield 6042 calories. Thus, again, the wages of casual as well as permanent laborers are too high to be nutrition-based efficiency wages.

In Table 4 I report wages for the state of Maharashtra in 1983, which are taken from *Agricultural Wages in India*, an annual publication of the Ministry of Agriculture of the Government of India. Daily wages are reported for 'field labor,' which is a category which lumps together plowmen, sowers, reapers, harvesters,

Table 4

Daily wage rates of adult male field labor in Maharashtra, 1983

	Rupees	Calorie equivalent
Lowest daily wage for male field labor (April)	6.08	5333

Source: Daily wage rates for field labor, which includes plowmen, sowers, reapers, harvesters, transplanters, etc., are reported separately for each month in *Agricultural Wages in India*. I have reported the lowest figure for the month of April. The calorie equivalent of 1-rupee wages is from Subramanian and Deaton (1994). Their computations are based on a sample of 5630 households, ten each in 563 villages, collected by the National Sample Survey Organization. Respondents were asked to recall how much they had consumed of more than 300 items over the previous 30 days. These quantities were converted into calorie equivalents using the calorie content tables in Gopalan et al. (1989). Subramanian and Deaton report that for the sample as a whole, 1000 calories cost 1.14 rupees. Accordingly I compute the calorie equivalent of 6.08 rupees =  $(6.08/1.14) \times 1000 = 5333$ .

transplanters, etc. One or more villages are selected in each district and the 'most common wage' is reported from each village in each month. The average of these (across villages) is then reported as the daily wage for the relevant month for the state of Maharashtra.

The lowest daily wage for men for field labor, which occurs in the month of April, is more than 6 rupees. Using Subramanian and Deaton's estimates of the cost of calories (see below), this wage would purchase more than 5333 calories. Using the same kind of reasoning as above, it is clear that an employer could obtain labor at a cheaper rate per efficiency unit by providing (say) 2500 calories in the form of meals.

Subramanian and Deaton's computations are based on a sample of 5630 households, ten each in 563 villages, collected by the National Sample Survey Organization during 1983. Respondents were asked to recall how much they had consumed of more than 300 items over the previous 30 days. These quantities were converted into calorie equivalents using the calorie content tables in Gopalan et al. (1989). Subramanian and Deaton report that the bottom 10% of households (in terms of per capita household expenditure) obtained 1000 calories for 0.88 rupees. For the sample as whole, the average cost of 1000 calories was 1.14 rupees. The calorie equivalent in Table 5 (5333) is based on the higher estimate. Using the lower figure (0.88 rupees for 1000 calories) the calorie equivalent of the wage works out to 6909 calories.

Finally, it is worth noting the evidence from a recent study which investigated 448 rural households in the Bukidnon province of the Philippines, over the period August 1984–August 1985. Bouis and Haddad (1990) collected data on, among other things, wage rates, caloric intake, and nutrition status four times at intervals of 4 months. They find that while better long-term nutritional status (as measured by height) does increase wages, greater caloric intake does not have any impact. They do caution however, that (a) wages are a crude measure of productivity, and (b) caloric intake (measured using the 24-h recall method) at four times during the

year could be a poor measure of average caloric intake. Still, if we accept their estimates, the EWM is not appropriate. Foster and Rosenzweig (1993) find, on the other hand, that caloric intake impacts piece-rate earnings but not time wages. They argue that this suggests that time-wage employers do not know how many calories their workers are consuming, rendering the EWM inapplicable. It is interesting to note that the lowest average wage paid to men is for weeding (paid mainly in time wages) and works out to 14.91 pesos day<sup>-1</sup> (Bouis and Haddad, 1991, p. 58), which is worth close to 7000 calories.<sup>7</sup>

## 6. Some qualifications and concluding remarks

Our analysis relies heavily on Behrman and Deolalikar's estimates of the impact of caloric intake on productivity. It is possible that there are non-linearities in the relationship which are not reflected in these estimates. If in fact over the relevant range caloric intake has a much stronger impact on productivity than their study found, unemployed workers may not be able to undercut in the manner discussed above. Thus, if it is true that (say) a worker who consumes 2500 calories is one-fifth as productive as someone who consumes 5000 calories, our conclusions would be different. The reader will recall, however, that among the various estimates produced by Deolalikar (1988) and Behrman and Deolalikar (1989), I used the one which was most favorable to the EWM.

This paper focuses specifically on the question of nutrition as a determinant of productivity. It is quite possible that worker productivity may depend not just on nutrition, but also on shelter, clothing, and other consumption items; consequently, wages may be rigid because of nutrition and other factors. My analysis does not address this possibility. Still, showing that nutrition considerations alone cannot account for wage-rigidity is a useful step forward, given that there is so little direct evidence regarding a model which was first formulated over 3 decades ago.

Another concern here is that we have ignored differences in health status. The unemployed worker may be unable to undercut an employed worker because of poorer health, not just because of lower caloric consumption. At one level this is true in any labor market; sick workers or weak workers may not be able to do the job. In the context of the nutrition-based efficiency wage model, however, poor health can be endogenous. A worker may be healthy in one year but, if he fails to find a job, may then be in poorer health in the next year, and will not find work again.<sup>8</sup> We cannot evaluate this possibility without time-series data. In my

<sup>7</sup> Bouis and Haddad (1990, p. 94) report that the number of calories obtained per peso spent on food is 476 for corn laborers, and 468 for corn laborers. Using the lower figure, the calorie equivalent of the average daily wage of men for weeding is 6978 calories.

<sup>8</sup> Dasgupta and Ray (1986) refer to this as "cumulative causation."

reading of the literature on India, however, I have not come across any examples of wage-rates which are low enough to have led to rationing in the labor market which then led to ill-health. I do not know of any evidence that suggests that ill-health is a *consequence* of nutrition-based involuntary unemployment.

It may well be true, however, that a worker who falls sick because of some random event may then be unemployable in that year and may fall further sick (because he did not find work and suffered poor nutrition) and be even less employable. Alternatively, the child of (say) an agricultural worker who has had very poor nutrition all of his/her life may have poor health and may not be very productive and may fall into an 'unemployment trap' of the sort discussed above. This is certainly realistic. In this sense, nutrition/health considerations are undeniably relevant in determining employment prospects.

Finally, I am not arguing that the nutrition-based efficiency wage model is never valid; there could be cases where wages are low enough for it to be applicable. However, in the examples which I present, which are from contemporary widely used Indian sources, the model does not seem to apply.

Thus, the findings of this paper can be summarized as follows. Given the level of wages our analysis suggests that employed workers can be undercut by a physically identical worker even if he has only wage income. If there are workers who are unemployed because they simply cannot supply efficiency units of labor cheap enough, even at a very low wage, they must be in much poorer health than the typical employed worker. Their health must be so poor that even when they are consuming 2500 or more calories, they are less than half as productive as the typical employed worker.

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